

Trade, regulations, and income [☆]

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Abstract

We examine the relationship between openness and per-capita income using cross-country data from 126 countries. We find that trade leads to a higher standard of living in flexible economies, but not in rigid economies. Business regulation, especially on firm entry, is more important than financial development, higher education, or rule of law as a complementary policy to trade liberalization. Specifically, after controlling for the standard determinants of per-capita income, our results imply that a 1% increase in trade is associated with more than a one-half percent rise in per-capita income in economies that facilitate firm entry, but has no positive income effects in more rigid economies. The findings are consistent with Schumpeterian “creative destruction”, which highlights the importance of new business entry in economic performance, and with previous firm-level studies showing that the beneficial effects of trade liberalization come largely from an intra-sectoral reallocation of resources.

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1. Introduction

Does openness to trade lead to better economic performance? Traditional theory predicts that openness enhances specialization, raising the level of income. In addition, beneficial productivity effects will arise if bad

firms exit and good firms enter and expand as a result of increased competition from foreign producers and greater market opportunities abroad. A large empirical literature explores trade as one potential explanation for the wide variation in per-capita incomes across countries. While the literature generally finds positive income effects of openness, the results are not always robust to controlling for the quality of institutions and geography.¹ This has generated some controversy about trade’s contribution to improving living standards.

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¹ Dollar (1992), Ben David (1993), Sachs and Warner (1995), Frankel and Romer (1999), and Wacziarg and Welch (2003) find evidence that trade enhances economic performance. Rodríguez and Rodrik (1999) and Rodrik et al. (2004) show that in many cases the results break down when variables representing institutions and geography are included in the analysis.

Why would some countries fail to reap the benefits of increased trade? One explanation is that distortionary domestic policies limit the positive effects of trade on economic performance. Since the gains from trade are expected to come from a reorientation of resources between and within industries, domestic policies that restrict factor mobility could curtail the gains from trade. In this paper, we explore whether complementary domestic policies are necessary for trade to enhance income.

We examine six domestic policies: business and labor regulations, property rights, financial development, education, and rule of law, each of which might affect the mechanism through which trade enhances income. Specifically, excessive business and labor regulations could restrict the reallocation of production to comparative advantage sectors thus reducing the gains from trade. Formal property rights are important to produce capital and secure assets; without them, trade may have little effect on business development and expansion. Similarly, increased financial development eases constraints to entrepreneurs, which may be key to sectoral expansion. A low level of education could lead to concentration in basic activities, reducing the returns from increased trade. Finally, rule of law, which measures governance more generally (including such diverse goals as crime prevention, political stability, and judicial systems), could reduce investment and limit the gains of trade.

We find that each of the indicators is significantly correlated with per-capita income; but only the first three, which directly affect the mobility of resources, influence significantly the correlation between trade and per-capita income. Especially important is the ease of starting a business: increased trade is positively correlated with income in economies that facilitate firm entry, but not in more rigid economies. Moreover, after controlling for ease of entry, the positive relationship between openness and per-capita income is more robust than has been found previously in the literature.

Using levels regressions, and controlling for geography and size, we find that a 1% increase in trade is associated with more than a one-half percent increase in per-capita income in the top half of the sample according to ease of business entry. There is, however, no evidence of a positive correlation between trade and income for countries in the bottom half of the sample. Using predicted trade, generated from a regression of bilateral trade on distance, as an instrument for openness, we find evidence that increased trade leads to higher income only in economies without excessive regulation. Results using alternative measures of open-

ness confirm that the income effect of trade is significantly reduced in excessively regulated economies. Finally, we examine the effect of trade growth on income growth in recent years. The results from the growth regressions are consistent with excessive regulation reducing the gains from trade.

The importance of entry regulation, as compared with other government policies, adheres to Schumpeterian “creative destruction”, where innovative entry by entrepreneurs is the force that leads to higher income in the long term. It is also consistent with recent empirical studies on industrial structure, productivity, and trade. Empirical evidence shows that entry regulation has large effects on industrial structure and adjustment (Alesina et al., 2005; Klapper, Laeven and Rajan, 2006; Fisman and Sarria-Allende, 2004). In high-growth industrial countries, there is evidence of large shifts in the production structure in response to changes in world prices (Redding, 2002). Firm-level studies show that the benefits from trade liberalization come largely from firm entry, exit, and expansion, as opposed to direct productivity gains (Pavcnik, 2002; Bernard and Jensen, 2004), and that new firms make an important contribution to productivity growth, especially in developing countries and advanced sectors (Bartelsman et al., 2004). Recent theoretical work provides a large role for this type of churning in producing gains from trade (Melitz, 2003).

2. Methodology

Trade can foster resource reallocation only if factor movement is not restricted. Previous cross-country studies of trade and income may suffer a bias since they do not control for the regulatory regime and other areas of governance potentially affecting resource allocation. This paper provides a remedy by allowing the trade elasticity of income to depend on domestic policies. Most importantly, this enables us to determine whether and which domestic policies matter for trade to have a positive effect on income. In the cross-sectional analysis, the dependent variable is the log-level of real per-capita income at PPP. We estimate the following equation:

$$\begin{aligned} \text{Per-capita Income}_i = & \beta_0 + \beta_1(\text{Trade/GDP})_i \\ & + \beta_2(\text{Trade/GDP} \times \text{Governance Index})_i \\ & + \beta_3(\text{Governance Index})_i \\ & + \beta_4(\text{Population})_i + \beta_5(\text{Landlocked})_i \\ & + \beta_5(\text{Distance to Equator})_i + \varepsilon_i \end{aligned} \quad (1)$$

Table 1
Summary statistics of the main variables

Variable	Mean	SD	Median	Min	Max	NOB	Years	Source
Per-capita GDP, PPP	9129	9685	4876	488	34,872	126	Avg(2000–04)	WDI
Trade/GDP	0.826	0.455	0.705	0.209	3.155	126	Avg(2000–04)	WDI
Secondary school	0.733	0.361	0.815	0.065	1.685	101	Avg(2000–04)	WDI
Finance	0.465	0.381	0.360	0.048	2.570	112	Avg(2000–04)	WDI
Rule of law	0.009	0.997	−0.315	−1.790	2.030	126	Avg(2000–04)	KKM(2005)
Business entry	0.101	1.020	0.019	−2.286	2.612	126	2003	Doing business
Labor	0.129	1.191	0.133	−2.610	3.117	126	2003	Doing business
Registering property	0.075	1.020	−0.048	−1.795	5.190	126	2004	Doing business

Notes: Secondary school is the percent of the cohort that is enrolled in secondary school. It exceeds one in cases when a portion of students is older or younger than the population in the cohort—these are all industrial countries. Finance is the ratio of M2/GDP. Rule of law is an index reflecting general governance, including: crime, judiciary, and the enforceability of contracts. Business entry is an index of the number of procedures to start a business. Labor is an index of labor flexibility. Registering property is an index reflecting the number of procedures to register property. WDI is World Development Indicators, KKM (2005) is Kaufmann, Kraay and Mastruzzi (2005).

where per-capita income, trade/GDP, population, and distance to equator enter in logs. We include in the regression equation each of the six governance indices—firm entry, labor regulation, property rights, education, finance and rule of law—and their interactions with trade separately. The null hypothesis to be tested is that the effect of openness on income is the same irrespective of the extent of governance as measured by the indicators. Thus, if the null is rejected then the coefficient on the interactive term between openness and the regulation index (β_2) will be significantly different from zero.

In line with previous evidence, we expect that an increase in openness will lead to higher income. Better governance, as reflected by indices of regulation, financial depth, education, and rule of law, would enhance income through its effect on investment, productivity and new entry. Countries with a larger population (and a larger market size) may have higher incomes because of scale economies. Countries that are landlocked and closer to the equator are expected to have lower incomes.

3. Data

The dependent variable is the level and average growth of real per-capita income at PPP. For the levels regressions, per-capita income is measured as the log-level of per-capita GDP in constant 2000 dollars in PPP terms from WDI. We average the data for the years 2000–2004 to remove any potential oddities in a given year. For the growth regressions, we use growth in real PPP-adjusted per-capita income from 2000 to 2005. It is standard practice to use PPP-adjusted GDP because it more accurately captures the standard of living across different countries and is not subject to large re-orderings in rank as a result of exchange rate fluctuations.

Our regulation indices are composed of data on labor regulations, business entry regulations and property rights, and available for a large group of countries from the “Doing Business” dataset, World Bank (2003 and 2004).² Data on entry and labor are benchmarked to January 2003 and data on property rights are benchmarked to January 2004. We use the first year of data available from Doing Business for each variable, as later years may be influenced by previous year’s rankings.³

The index of entry regulations is the number of procedures it takes to start a business. The labor regulations index is an average of three indices covering flexibility of hiring, conditions of employment, and flexibility of firing, which are based on an examination of detailed provisions in the labor laws of each country. Property rights are measured as the number of procedures involved in registering commercial property. Each of the three indices is rescaled such that their mean values are 0 and standard deviations are 1. We rescale before merging the data on income, trade and other variables. In each case we lost 7 observations, as a result the sample mean and variance are slightly different from 0 to 1 (Table 1).

Financial development is measured as the log of the ratio of M2 to GDP as is standard in the literature. Secondary school enrollment is the log of the percent of the cohort that is enrolled in secondary school. Both measures are taken from the World Bank’s World Development Indicators (WDI) and are averages of data

² The first two were compiled by Djankov et al. (2002) and Botero et al. (2004).

³ Countries that rank poorly in the first year have in some cases reformed in order to improve on the rankings. In addition, as these measures have been incorporated into World Bank projects, some countries have reformed in order to access donor financing.

Table 2
Starting a business by region

Region	Mean	SD	Median	Min	Max	NOB
North America	−1.517	0.725	−1.421	−2.286	−0.845	3
West Europe	−0.642	1.062	−0.845	−1.998	1.748	17
South Asia	−0.327	0.473	−0.557	−0.845	0.307	5
East and Central Europe	0.187	0.874	0.019	−1.421	2.612	24
East Asia	−0.288	1.007	−0.269	−2.286	0.883	15
Middle East and North Africa	0.283	1.009	0.451	−1.421	2.324	12
Sub-Saharan Africa	0.461	0.785	0.451	−1.133	2.612	30
Latin America	0.711	0.955	0.595	−0.845	2.612	20
Total	0.101	1.020	0.019	−2.286	2.612	126

Note: Initial data for 85 countries collected in Djankov et al. (2002). These data are collected by the World Bank's Doing Business Project for 2003.

for available years from 2000 to 2004. Rule of law is from Kaufmann et al. (2005) and averaged for available data during the period 2000–04. It is constructed from indicators reflecting peoples' confidence in and adherence to the rules of society, including crime incidence, the effectiveness of the judiciary, and the enforceability of contracts.

Table 1 shows the summary statistics of these variables for the countries in the sample. Table 2 shows summary statistics for the ease of starting a business (the index that we focus on) for each region. With respect to business entry, Latin America and the Caribbean is the most regulated region, North America is the least regulated region. New Zealand, Canada, Australia, Finland and Sweden are the five least regulated countries. Brazil, Algeria, Belarus, Mozambique, Colombia and Chad are the five most regulated. There is significant variation within regions, with the best countries in all of the regions outperforming the average in Western Europe.

We use four measures of trade openness. The first is the log of the ratio of total trade to GDP in current local currency. The second is the log of the ratio of trade to GDP measured at PPP. Both are from WDI data. The third is the log of the average trade-weighted tariff in the country from the UN Comtrade database. The fourth is the change in the trade–GDP ratio from 1995 to 2000 from WDI.

We add as explanatory variables in the regression the log of population as a proxy for market size, with data taken from the WDI. In addition, we include a dummy variable for landlocked countries, and log of distance from the equator, measured as the absolute value of the latitude of the country's capital city. Both are taken from

the Dollar and Kraay (2003) dataset and augmented by the authors where necessary. We also use data on the legal origin of countries as well as data on their proportions of English and European—languages speakers, drawn from Djankov et al. (2002) and Dollar and Kraay (2003), respectively. We start with the Doing Business dataset of 133 countries and delete those countries for which data are not available for our explanatory variables. This leaves us with a maximum of 126 countries in the levels regressions, listed in Table A1.

4. Results

Results from estimating Equation 1 are reported in Table 3. Column 1 reports the results from a standard cross-country regression on per-capita incomes (at PPP), with errors adjusted for heteroskedasticity. The coefficient on openness is positive and significant at the 10% level and indicates that a 1% increase in openness raises per-capita income by 4%. Countries further away from the equator have higher incomes. Being landlocked hurts income significantly. Population has no significant effect on income.

Columns 2–7 report the results including each of the Doing Business regulation indices separately along with the respective interactive term. All of the variables have the expected signs. The negative and significant coefficients on the regulation indices for starting a business, hiring and firing, and registering property imply that less regulated countries have higher incomes (higher values on the regulation index reflect more regulation). The coefficients of interest are on the interaction terms between openness and the regulation indices. The interactive terms are negative and significant implying that the positive effect of openness is reduced when regulation is excessive (when the regulation index is large and positive) and enhanced when regulation is moderate (when the index is negative). Put another way, moderate regulation leads to higher per-capita income and the effect is larger in a more open economy. In each case, we can reject, at least at the 10% level, that the coefficient on openness and on the interactive term are jointly equal to zero.

In Columns 5–7, we include secondary school enrollment to population of cohort, financial development, and rule of law. Each of the indices separately is robustly significant and has the expected sign. The signs on the interactive terms are also as expected, however, they are never jointly significant with the trade variable or individually highly significant.

In column 8, we include the three indicators of the regulatory environment together. The strongest effects

Table 3

The effect of trade on income levels

	Dependent variable: ln(GDP per capita at PPP)							
	Regulation Indices				Education	Finance	Rule of law	
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
ln(Trade/GDP)	0.396*	0.318*	0.125	0.320*	−0.317	−1.096*	0.164	0.174
	[1.77]	[1.73]	[0.73]	[1.70]	[0.40]	[1.70]	[1.30]	[1.07]
Landlock	−0.868***	−0.759***	−0.883***	−0.893***	−0.475**	−0.465***	−0.439***	−0.834***
	[5.07]	[4.38]	[5.30]	[5.53]	[2.35]	[2.87]	[3.24]	[5.03]
ln(Distance from equator)	0.042***	0.040***	0.042***	0.040***	0.018***	0.033***	0.019***	0.039***
	[9.23]	[9.23]	[10.48]	[10.05]	[4.41]	[8.27]	[5.60]	[9.48]
ln(Population)	0.005	0.024	−0.029	0.025	−0.047	−0.063	0.034	0.011
	[0.08]	[0.38]	[0.48]	[0.40]	[0.95]	[1.03]	[0.86]	[0.18]
ln(Trade/GDP) * entry		−0.435**						−0.372**
		[2.59]						[2.26]
Entry		−0.342***						−0.174**
		[4.35]						[2.11]
ln(Trade/GDP) * labor			−0.204**					−0.022
			[2.13]					[0.22]
Labor			−0.313***					−0.201***
			[5.10]					[3.06]
ln(Trade/GDP) * property				−0.366**				−0.145
				[2.11]				[0.84]
Property rights				−0.378***				−0.250***
				[4.36]				[3.22]
ln(Trade/GDP) * indicator					0.079	0.310*	0.069	
					[0.40]	[1.80]	[0.69]	
Indicator					1.016***	0.723***	0.771***	
					[8.01]	[6.16]	[13.81]	
Test: ln(Trade/GDP)=		4.24	2.86	3.74	0.08	1.62	1.96	3.36
LN(trade/GDP) * indicator=0		(0.02)	(0.06)	(0.03)	(0.92)	(0.20)	(0.14)	(0.01)
Observations	126	126	126	126	101	112	126	126
R-squared	0.50	0.56	0.57	0.56	0.72	0.57	0.76	0.62

Robust *t*-statistics in brackets. *P*-values in parentheses.

*Significant at 10%; **significant at 5%; ***significant at 1%.

appear to come from the regulation of business entry. The coefficient on the interaction between entry and openness does not change much and is robust to the inclusion of the other interactions. In contrast, the coefficients on the other interaction terms fall sharply and are no longer significant.

The results from column 2 on business entry imply that countries with the regulatory index above 0.73 (0.318/0.435=0.73) would not experience a positive income effect—thirty countries fall in this range. In the extreme cases, the results point to a 1% increase in trade leading to a 0.8% decline in income in Belarus, Chad, and Colombia (the most regulated countries), and to a 1.3% increase in income in Australia, Canada, and New Zealand (the least regulated countries).

Fig. 1 shows a scatter plot of trade openness and per-capita income in the top half of countries according to regulation of entry. The left panel shows trade and income in the 50% of countries where regulation of

entry is least restrictive. The partial correlation between openness and income is positive and significant (coefficient on openness=0.76, *t*-stat=2.56). The right panel plots the same figure for the countries with the most restrictive laws. The correlation is negative and insignificant (coefficient on openness=−0.08 and *t*-stat=−0.29). The scatter plot also suggests that the link between income and openness is stronger in economies with limited regulation and weaker or absent in the more regulated economies.

The robustness of the entry index is consistent with creative destruction being a vital part of income creation. Greater openness provides new opportunities, but if firm entry is restricted then potential innovation is limited. That entry is more important than labor as a complementary policy may be because even with labor restrictions, workers can move to better paying jobs in an expanding export sector. Entry regulations, however, will limit expansion of the export sector in industries

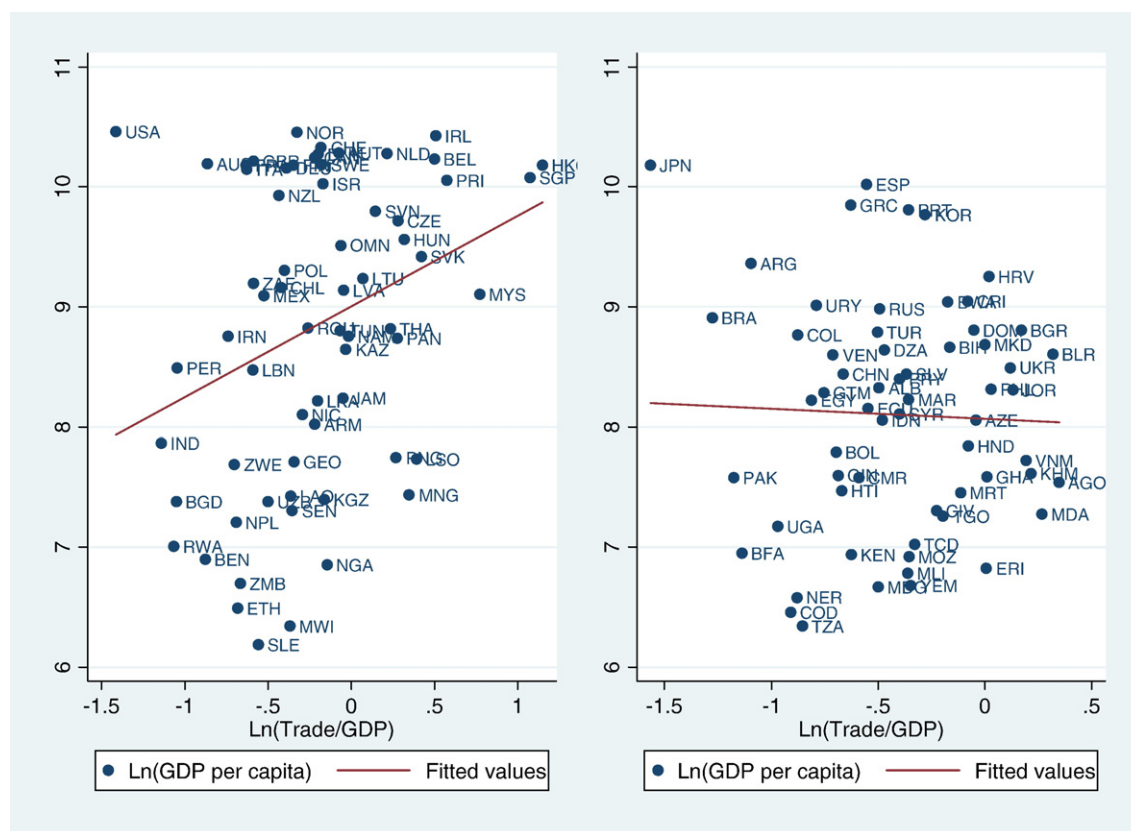


Fig. 1. The correlation between trade and income in least and most regulated countries. The left panel shows trade and income in the 50% least regulated countries (regulation index at or below the median). The right panel shows trade and income in the 50% most regulated countries (above the median regulation index). The measure of entry regulation determines the cutoff.

where new firms are important for growth and vital for productivity gains.

5. Trade regulation and income, robustness tests

In Table 4, we perform a series of robustness tests. Column 1 repeats the results from Column 2 of the previous table on entry, using robust regression analysis with Maximum Likelihood-like estimators to ensure that outliers are not driving the results.⁴ The results are much stronger indicating that the effect of trade and regulations on income could be more important for a typical country.

Column 2 repeats the results from Table 3, using a dummy for the bottom 50% in terms of the regula-

tion index. The results imply that there is no gain from trade in the more regulated economies, and that other countries gain over half a percent in income for a 1% increase in openness.

Column 3 reports the basic results with six regional dummies.⁵ Note that the inclusion of regional dummies is a very strong test, as regional variation also reflects differences in openness to trade and the regulatory structure (See Table 2). Most cross-country studies do not use regional dummies or use dummies for only two or three regions.⁶ Even accounting for regional variation in income, the effect of trade in highly regulated economies is significantly diminished.

⁴ Robust analysis controls for the potential outlier problem in this sample (rreg in Stata). Robust regression analysis is done using iteratively re-weighted least squares—the scale is the median absolute deviation about the median residual divided by a constant (Huber, 1981). Results from quantile regression are similar. The main outliers are the US and Japan, which have very high income. Robust analysis ensures that these data points are not driving the results.

⁵ Dummies are for East Asia and the Pacific, Middle East and North Africa, South Asia, West Europe, North America, Sub-Saharan Africa, and Latin America (Europe is excluded).

⁶ For example, Dollar (1992), Frankel and Romer (1999), and Dollar and Kraay (2003) do not use regional dummies. Rodríguez and Rodrik (2001) show that Dollar's (1992) results are broken with just three dummies (Latin America, East Asia and Africa).

Table 4
The effect of trade and entry regulation on income levels

	Dependent variable: ln(GDP per capita at PPP)						
	[1]	[2]	[3]	[4]	[5]	[6]	[7]
ln(Trade/GDP)	0.356*	0.712**	0.187	0.177			0.339**
	[1.91]	[2.61]	[0.96]	[1.61]			[2.52]
ln(Trade/GDP PPP)					0.829***		
					[8.64]		
ln(Average tariff)						−0.495***	
						[3.11]	
Openness measure * entry	−0.519***		−0.328***	−0.173	−0.170**	0.217**	−0.397***
	[3.33]		[2.84]	[1.59]	[2.06]	[2.13]	[3.24]
Entry	−0.336***		−0.323***	0.083	−0.228**	−0.534**	0.016
	[3.43]		[4.18]	[1.15]	[2.21]	[2.28]	[0.17]
Ln(Trade/GDP)*bottom 50%		−0.763**					
		[2.08]					
Bottom 50%		−0.566***					
		[3.19]					
Landlock	−0.767***	−0.841***	−0.541***	−0.450***	−0.439***	−0.766***	−0.579***
	[4.07]	[4.80]	[2.94]	[3.48]	[2.91]	[4.48]	[3.69]
ln(Distance from the equator)	0.040***	0.041***	0.027***	0.020***	0.028***	0.030***	0.022***
	[8.20]	[9.82]	[3.09]	[6.01]	[7.71]	[6.60]	[5.91]
ln(Population)	0.004	0.002	0.032	0.018	0.130**	0.024	−0.038
	[0.06]	[0.03]	[0.46]	[0.47]	[2.54]	[0.45]	[1.00]
Rule of law				0.814***			0.612***
				[12.87]			[6.36]
Test: ln(Trade/GDP)=ln(trade/GDP)*entry=0	7.95	3.41	4.72	3.02	52.66	8.97	8.32
	(0.00)	(0.04)	(0.01)	(0.05)	(0.00)	(0.00)	(0.00)
Regional dummies	No	No	Yes	No	No	No	No
Observations	126	126	126	126	119	105	99
R-squared	0.53	0.54	0.66	0.78	0.70	0.52	0.64

Robust *t*-statistics in brackets. *P*-values in parentheses.

*Significant at 10%; **significant at 5%; ***significant at 1%.

Next, we examine whether the result is robust to the inclusion of rule of law in the regression equation. Rodríguez and Rodrik (2001) argue that measures of institutions—such as rule of law—dominate openness in standard cross-country regressions.⁷ Indeed, in Table 3 (column 7) rule of law is highly correlated with income. When rule of law is included with Entry and the interaction term (column 4), the coefficients on the trade and on the interactive term decline, however, their signs are robust and they are jointly different from zero at the 5% level, consistent with the effect of openness being reduced in more rigid economies. It should be noted that while the correlation is very strong between rule of law and income, a serious concern about including rule of law is that it is a perceptions/survey based indicator,

and responses are likely to be influenced by the stage of development (Glaeser et al., 2004).

Next, we use trade as a percent of GDP adjusted for PPP as the explanatory variable, which will pick up price effects that could distort measured openness.⁸ The results are reported in column 5 of Table 4. The results on trade are the same in sign though in this case, as would be expected, the evidence that openness generates income is more robust. There is still significant evidence that increased trade in highly regulated economies diminishes the effect of trade on income.

⁸ Alcalá and Ciccone (2004) argue that trade relative to GDP at PPP, which they call “real openness”, is a better measure of openness than (nominal) trade to (nominal) GDP, while Rodríguez and Rodrik (2001) maintain that the reverse is true. The motivation for using real openness is that if trade raises productivity in the tradables sector, the price of non-tradables will rise and this can depress the measure of openness despite increased trade. However, as Rodríguez and Rodrik point out, real openness may also suffer a bias. If the tradable sector experiences a productivity gain for any non-trade reason, measured openness will increase, even if there is no increase in trade. Using real openness can therefore bias us toward accepting the relationship between openness and income, even when one is absent.

⁷ There is a large literature on the importance of institutions in economic performance. Acemoglu et al. (2001) show that institutions instrumented by settler mortality rates have large effects on income levels. Albouy (2006), however, revisits the data, casting some doubt on whether settler mortality is a reliable instrument. Djankov et al. (2002) show that it is not just institutions that matter for economic performance, but the origin of those institutions.

A further critique on the standard measure of openness, trade/GDP, is that it is an outcome and not a measure of policy. We use the log of the average trade-weighted tariff as a policy measure of openness (results are similar if we use a simple average tariff), under the assumption that variations in average tariffs are likely to reflect different policy stances. Column 6 reports the results using the average tariff as the measure of openness. In this case we expect countries with lower tariffs to have higher income and that regulation would lessen this effect. The results confirm this.

To ensure that the results are not driven by differences between industrial and developing countries, the last column reports the results for a sample of non-OECD countries. The positive effect of trade on income is much stronger and more robust in this case, even for the most difficult of the robustness tests, which includes rule of law. The interactive effect of regulation and trade on income is also stronger and more robust.

Next, we address the endogeneity problems in the previous regressions. First, countries with higher incomes may engage in more trade than others. Technological developments may expand exports and income while domestic demand for imports may grow with rising incomes. This will lead us to overestimate the effect of both trade and the interactive term on income. There may also be omitted variables that are correlated both with per-capita incomes and trade that will bias the coefficients on trade, such as factors like infrastructure or governance. While instrumental variables help to solve these problems, there are other potential concerns introduced with an instrumental variables approach. In particular, we would like to pick up the extent to which exogenous policy differences lead to more openness in some countries. What we actually estimate is the extent to which exogenous variation in location–distance to other markets–leads to more trade. Note that to the extent that the coefficient on openness is likely to be overestimated without the use of instrumental variables, the joint effect that we identify is also likely to be overestimated (i.e. less negative than it should be). That the interactive term is robustly negative without instrumenting speaks to its significance.

Following Frankel and Romer (1999), we use the fitted values of trade predicted by the exogenous variables in a gravity model as an instrument for trade.⁹ As fitted trade

alone is a weak instrument, and in order to test over-identifying restrictions, we use remoteness from other markets as an additional instrument.¹⁰ The intuition is that countries that are far from big markets have less opportunity for trade. A potential problem is that remoteness may be independently associated with GDP per capita, for example, if remote areas are less inhabitable for reasons not owing to trade. Given that we control for distance from the equator, landlocked, as well as regions this is less worrisome, as these characteristics more directly reflect geography. Indeed, in a standard cross-country regression, remoteness is neither economically nor statistically significant when regional dummies are included. Studies that use only fitted trade as an instrumental variable, either do not control for geography or find it to be a weak instrument.¹¹ Using these instruments, we are essentially testing whether the part of trade that results from geography has a positive influence on income.

Second, we instrument for the regulation index. Countries with rising or high incomes are more likely to face better regulatory environments. As countries grow faster, the costs of a heavy regulatory burden in the face of expanding markets and business opportunities become higher, thereby accelerating regulatory reform. The government may face greater pressures from the private sector to remove administrative constraints. We instrument for the regulation index with the share of population speaking English or a major European language as well as the legal origin of countries. The premise is that colonial origin influences institutional heritage. A greater fraction of the population speaking English or major European language is likely to indicate the country had a longer/deeper experience with colonization. Legal origin determines the type of regulatory structure and the disposition of countries to reform, as well as the pace of reforms (La Porta et al., 1998). The use of legal origin as an instrument for regulatory structure is well established in the finance

¹⁰ Specifically, the measure is $remote_j = \frac{1}{\sum_k \frac{GDP_k}{D_{jk}}}$, $j \neq k$, where D is

distance and there are k foreign countries. The advantage of this measure, as compared with a measure of GDP-weighted distance, is that it does not put excessive weight on very distant countries.

¹¹ For example, Frankel and Romer (1999) do not control for geography. Frankel and Rose (2002) do not include landlocked in the growth regression, they show robustness tests with distance from the equator and a few regional dummies but not with a full set of regional dummies or with both distance from the equator and regional dummies. Our test is more difficult to pass because we are controlling for several significant geographical characteristics simultaneously. Dollar and Kraay (2003) also show that fitted trade alone is a weak instrument when geographic characteristics are included.

⁹ We obtain fitted bilateral trade shares (sum of imports and exports to GDP) for countries using bilateral trade data averaged for 2000–2004, and we then aggregate the bilateral trade shares for each country i across its trade partners j . We use as regressors for bilateral trade shares geographical variables such as a bilateral distance and a dummy for landlocked countries, and other variables such as a dummy for a common border, language variables, population.

Table 5
Controlling for endogeneity, instrumental variable regressions

Dependent variable: ln(GDP per capita at PPP)					
Endogenous variable	Trade	Trade and interaction	Entry	Entry and interaction	Trade, entry, and interaction
	(1)	(2)	(3)	(4)	(5)
ln(Trade/GDP)	0.753 [1.17]	0.193 [0.46]	0.131 [0.62]	0.072 [0.25]	−0.307 [0.86]
ln(Trade/GDP) * Entry		−0.463** [2.44]		−1.995* [1.85]	−1.126** [2.54]
Entry	−0.184* [2.15]	−0.342*** [3.80]	−0.262 [1.40]	−1.107* [1.69]	−0.969*** [3.61]
Landlocked	−0.475* [2.24]	−0.430** [2.16]	−0.433 [1.90]	−0.202 [0.72]	−0.199 [0.75]
ln(Distance from equator)	0.024** [4.64]	0.028*** [5.56]	0.024** [3.36]	0.032*** [3.77]	0.024*** [3.14]
ln(Population)	0.098 [0.68]	−0.018 [0.18]	−0.004 [0.04]	−0.022 [0.23]	−0.042 [0.47]
Shea R^2					
ln(Trade/GDP)	0.12	0.19			0.31
Entry			0.17	0.09	0.19
ln(Trade/GDP) * entry		0.44		0.08	0.21
Hanson J -stat	0.19	0.15	0.21	0.30	0.07
Regional dummies	yes	Yes	yes	yes	yes
Observations	111	111	111	111	111
R -squared	0.54	0.61	0.58	0.18	0.41

Robust z statistics in brackets.

*Significant at 10%; ** significant at 5%; ***significant at 1%.

Notes: Column 1: ln(trade/GDP) is instrumented, instruments are fitted trade and remoteness. Column 2: ln(trade/GDP) and ln(trade/GDP) * entry are instrumented, instruments are fitted trade and remoteness and interactions of them with entry. Column 3: Entry is instrumented, instruments are British legal origin, French legal origin, fraction of population speaking English. Column 4: Entry and ln(trade) * entry are instrumented, instruments are British legal origin, French legal origin, fraction of population speaking English and interactions between them and ln(trade/GDP). Column 5: ln(trade/GDP), Entry, and ln(trade/GDP) * Entry are instrumented, instruments are fitted trade, remoteness, British legal origin, French legal origin, fraction of population speaking English and fraction of population speaking a European language plus interactions between trade instruments and Entry instruments.

literature (as in Beck et al., 2000; Djankov et al. 2002; Claessens and Laeven, 2003).

Table 5 reports the results. The first two columns deal with the endogeneity of trade. Columns 1 reports results when we treat trade as endogenous, and instrument for openness with fitted trade and remoteness. In Column 2, we also instrument for the trade part of the interaction term using the instruments for trade multiplied by entry as the instruments. Trade is positive in both regressions but not significant. The interaction term is negative and highly significant, implying that increased trade leads to income gains in less regulated economies but not in more regulated economies.

The next two columns deal with the endogeneity problem of the entry index. Again, results suggest that increased trade leads to income gains only in less regulated economies. Finally, the last column instruments all three endogenous variables: openness, entry and their interaction. More regulation reduces income and trade increases income only in less regulated countries.

In all cases we cannot reject that the instruments are valid, as the P -values of the Hanson Statistic are above conventional confidence levels. The Shea R -squared provides information about the strength of the instruments (Shea, 1996). It is the partial R -squared from the instruments in the first stage regression, taking into account the extent to which multiple endogenous variables rely on the same instrument for identification.¹² The Shea statistics suggest that in most cases the variables are reasonably-well identified, except in column 4 when entry and the trade–entry interaction are included and only entry is treated as endogenous.

The levels regressions provide evidence that long-run growth is not helped by trade in highly regulated economies. However, it is possible that heavily regulated economies become more dependent on trade

¹² See Dollar and Kraay (2003) for a detailed discussion of weak instruments in cross-country regressions.

in the long run because of their inflexible domestic regulations, but that a higher level of trade in these economies is still associated with income growth. We now examine changes in openness and income in recent years to see if the results from the levels regressions are robust to changes.

Ideally, we would like to estimate the growth regressions over a long period, as in Dollar and Kraay (2003). However, to do this we would need the regulation index in each period, which is not available. As a result, we focus on growth from 2000 to 2005 and continue to use the regulation data from Doing Business. This approach is valid, assuming that regulations are slow to change and that values in 2003 are closely correlated with the values in 2000, the beginning of the period.

Fig. 2 shows a scatter plot of the lagged growth in the trade–GDP ratio (1995–2000) and growth in per-capita income at PPP (2000–2005). The left panel shows the relationship in the 50% of countries with the least restrictive entry laws and the right panel shows the plot

for the most restrictive countries. In the less restrictive countries, the partial correlation is 0.25, and is highly significant, with a t -statistic of 2.91. In the more restrictive countries, the correlation is 0.04, and is not significant, with a t -statistic of 0.38. This is suggestive of an important role for entry regulation in the relationship between trade and income growth. However, we have not controlled for other factors.

To do so we regress per-capita GDP growth from 2000 to 2005 (measured at PPP in constant 2000 dollars) on the initial value of log GDP per capita, the change over the previous five year in the log of average trade to GDP (1995–2000), the change in the lagged average inflation rate, and the change in the investment ratio. In all regressions, we instrument for initial GDP with its lagged level. We also include a dummy for members of the former Soviet Union (FSU), as these countries tend to be outliers in the period as a result of the transition to market (see Fig. 2). We report results for the entry–trade interaction, and also using a dummy for the 50%



Fig. 2. The correlation between trade growth (1995–00) and income growth (2000–05) in least and most regulated countries. The left panel shows lagged trade growth and income growth in the 50% least regulated countries (regulation index at or below the median). The right panel shows lagged trade growth and income growth in the 50% most regulated countries (above the median regulation index). The measure of entry regulation determines the cutoff.

Table 6
The effect of trade growth on income growth, 2000–2005

	Dependent variable: income growth			
	[1]	[2]	[3]	[4]
$d\ln(\text{Trade}/\text{GDP})_{95-00}$	0.043 [0.68]	0.072 [1.33]	0.185** [2.15]	0.129 [1.61]
$\ln(\text{Initial income})^a$	0.003 [0.26]	0.003 [0.28]	−0.001 [0.09]	−0.001 [0.05]
$d\text{Inflation}_{95-00}$	−0.027**	−0.026**	−0.026**	−0.020
$d(\text{Investment}/\text{GDP})_{00-05}$	0.006* [1.78]	0.006* [1.93]	0.006* [1.82]	0.005 [1.46]
FSU	0.218*** [7.74]	0.242*** [8.54]	0.228*** [8.99]	0.169*** [6.37]
Entry		0.023 [1.11]		
$d\ln(\text{Trade}/\text{GDP})_{95-00} * \text{Entry}$		−0.166** [2.02]		
$d\ln(\text{Trade}/\text{GDP})_{-1} * \text{bottom 50\%}$			−0.251** [2.33]	−0.201** [2.46]
Bottom 50%			0.014 [0.51]	0.014 [0.47]
Test A: $d\ln(\text{Trade}/\text{GDP})_{95-00} = d\ln(\text{trade}/\text{GDP})_{95-00} * \text{entry} = 0$		3.09 (0.05)		
Test B: $d\ln(\text{Trade}/\text{GDP})_{95-00} = d\ln(\text{trade}/\text{GDP})_{95-00} * \text{bottom 50\%} = 0$			2.84 (0.06)	3.04 (0.05)
Test C: $d\ln(\text{Trade}/\text{GDP})_{95-00} + d\ln(\text{trade}/\text{GDP})_{95-00} * \text{bottom 50\%} = 0$			0.98 (0.32)	1.18 (0.28)
Regional dummies	No	No	No	Yes
Observations	103	103	103	103
R-squared	0.46	0.5	0.49	0.53

Robust *t*-statistics in brackets. *P*-values in parentheses.

*Significant at 10%; **significant at 5%; ***significant at 1%.

^a Initial income (2000) is instrumented with income in 1995 when included.

most regulated countries interacted with lagged trade growth.¹³ We have a maximum of 103 observations: the number of observations was reduced because data for investment/GDP and inflation were only available for a subset of our countries.

Column 1 of Table 6 reports the baseline growth regression. The evidence that trade supports growth is absent in this sample. Column 2 includes the entry index and an interaction term between lagged trade growth and the index. The coefficient on the interaction term is negative and significant, implying that growth effects from trade are linked to the regulatory climate. The effect of openness and the interaction term are jointly significant at the 5 percent level (Test A).

Columns 3 repeats the exercise using a dummy for the 50% most regulated countries interacted with lagged

trade growth. The correlation between lagged trade growth and GDP growth is now positive and significant, however, the positive correlation is eliminated in the most regulated countries (Test C). Column 4 includes regional dummies. In line with results from the previous section, we find that increased trade is not significantly correlated with growth in the most heavily regulated economies, and the sign and significance of the coefficients imply that the effect is not the same for the most and least regulated economies. Additionally, we can reject that the effects of trade and the interaction term are jointly equal to zero (Test B).¹⁴

6. Conclusions

Cross-country regressions suggest that increased trade is associated with higher income. We show that

¹³ Chang et al. (2005) examine the effects of complementary reforms using growth regressions from 1960 to 2000. They find that a host of policies have interactive effects with trade, with entry among the most robust.

¹⁴ We also included lagged GDP growth instrumented with the lagged level, but it was not significant and the results did not change significantly.

this relationship is magnified in well regulated countries and breaks down in the most heavily regulated economies. The results hold for a host of robustness tests, including: using alternative measures of openness, controlling for regional dummies and rule of law, dropping OECD countries, instrumenting for trade and regulations, and examining correlations between lagged trade growth and income growth in recent years.

Following an analysis of six government policies, the paper provides one answer to the question of what complementary policies are necessary for trade to benefit an economy. In order for trade to improve living standards, the regulatory environment, especially for business entry, must be improved in heavily regulated countries. The logic is simple: if the structure of economic activity is rigid then trade has only a modest impact on the allocation of resources across and within industries, and hence only a modest impact on income. The importance of business entry highlights the role for

“creative destruction” in generating income subsequent to trade liberalization.

An interesting finding is that business entry is more important than labor restrictions as a complementary policy to trade. One explanation is that even with labor restrictions, workers can move to better paying jobs in an expanding export sector. Entry regulations, however, will limit the expansion of the export sector in industries where new firms are important for growth and vital for productivity gains.

Finally, our work has implications for the literature on trade and institutions as determinants of income. Our results imply that there is a primacy of institutions over trade in the most distorted economies—not only do bad institutions depress income, but they also prevent trade from improving the standard of living. The implication is that the countries that place an excessive regulatory burden on the private sector must have a strategy in place to improve their business climate before (or at least contemporaneously with) undertaking trade reform.

Appendix A

Table A1

List of 126 countries in the sample

Albania	Chad	Greece	Lesotho	Panama	Sweden
Algeria	Chile	Guatemala	Lithuania	Papua New Guinea	Switzerland
Angola	China	Guinea	Madagascar	Paraguay	Syria
Argentina	Hong Kong	Haiti	Malawi	Peru	TFYR of M
Azerbaijan	Czech Rep.	Indonesia	Mexico	Puerto Rico	Turkey
Armenia	Colombia	Honduras	Malaysia	Philippines	Thailand
Australia	Costa Rica	Hungary	Mali	Poland	Togo
Austria	Croatia	India	Mauritania	Portugal	Tunisia
Bangladesh	Ivory Coast	Iran	Mongolia	Korea	USA
Belarus	Congo	Ireland	Morocco	Moldova	Uganda
Benin	Dominican Rep.	Italy	Namibia	Russia	United Arab Emirates
Bolivia	Ecuador	Jamaica	Nepal	Rwanda	United Kingdom
Bosnia	Egypt	Japan	Netherlands	Senegal	Tanzania
Botswana	El Salvador	Jordan	New Zealand	Sierra Leone	Uruguay
Brazil	Ethiopia	Kazakhstan	Nicaragua	Singapore	Uzbekistan
Bulgaria	Finland	Kenya	Niger	Slovakia	Venezuela
Burkina Faso	France	Kyrgyzstan	Nigeria	Slovenia	Viet Nam
Cambodia	Georgia	Laos	Norway	South Africa	Yemen
Cameroon	Germany	Latvia	Oman	Spain	Zambia
Canada	Ghana	Lebanon	Pakistan	Sri Lanka	Zimbabwe

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